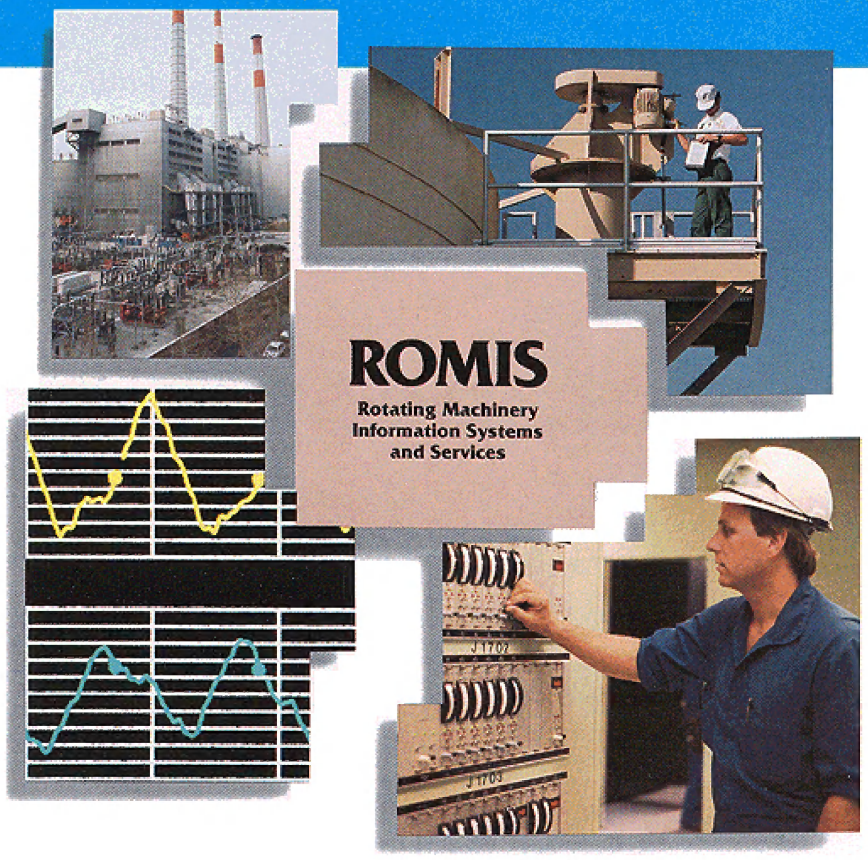

Predictive Maintenance:
Putting the pieces together

A guide on how to plan, justify, and implement a predictive maintenance program using rotating machinery information systems

Planning

Bringing people and their machinery information needs together

Reported by Coco Crum, Editor-in-Chief

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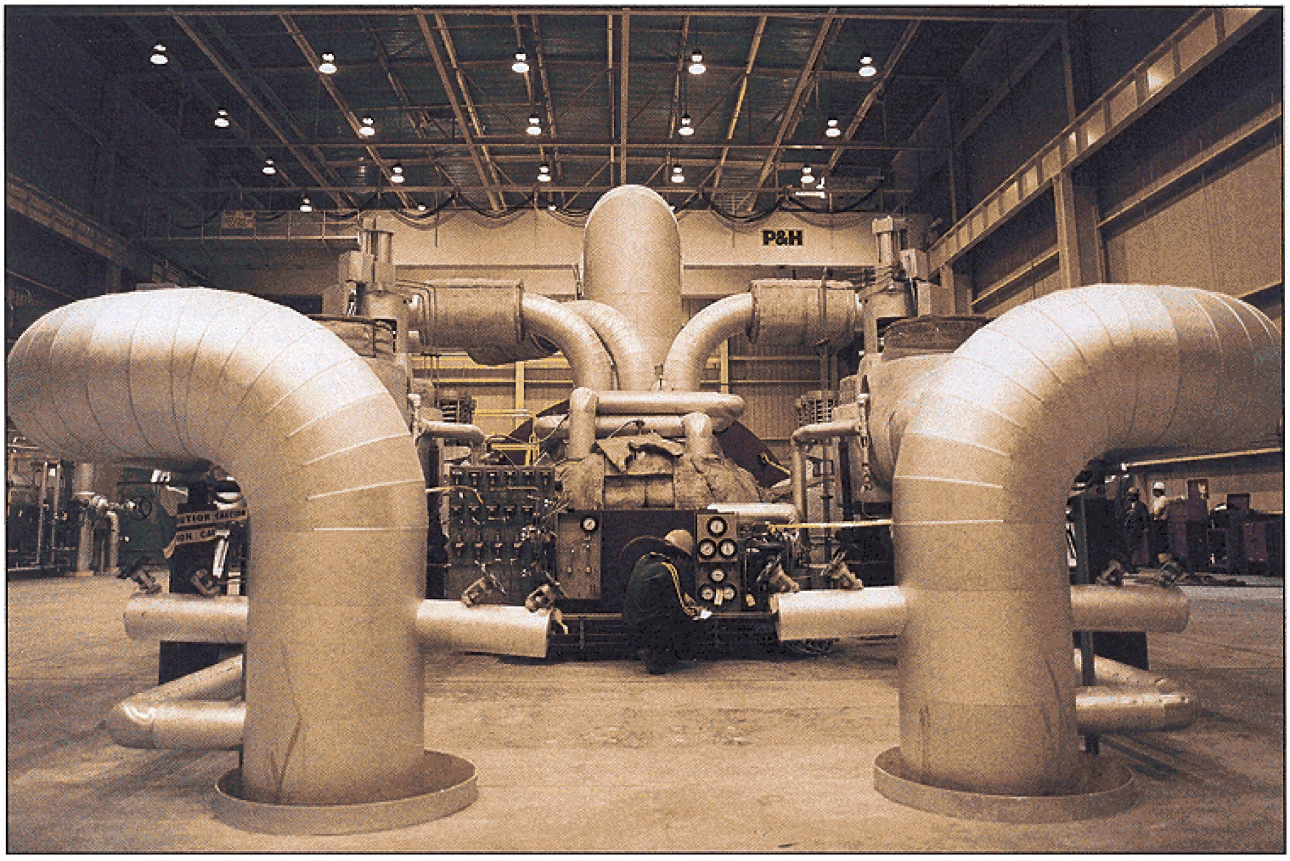


"Rotating machinery is classified by its criticality to your operation....The criticality determines the operating modes for acquiring information from each machine."

A predictive maintenance program for rotating machinery affects a wide range of people in a company—including production and maintenance personnel as well as corporate management. Their involvement in the planning stage is the key to successfully implementing a predictive maintenance program.

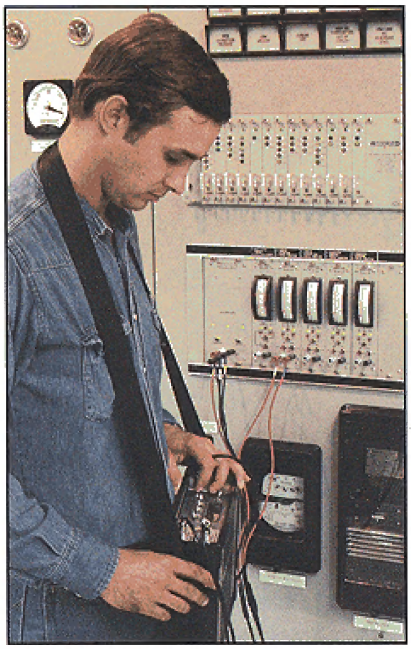
A predictive maintenance program is not something that one department can do alone, according to a February 1986 report in *P&IM (Production and Inventory Management) Review.* "It requires a high level of support from top management and the recognition of this support commitment throughout the entire organization," the magazine reports.

Consequently, planning a predictive maintenance program requires evaluating the operating and maintenance practices of your company and the machinery information needs of all personnel involved with rotating equipment.

Four basic questions will assist you in evaluating your predictive maintenance needs:

1. Who in my organization needs rotating machinery information for performing predictive maintenance?
2. What type of information is needed?
3. On what types of machinery is the information needed?
4. In what machine operating modes must the information be acquired?

Following is a detailed review of each question. The answers to these questions will guide you in developing a program that ensures the proper people within your organization receive the machinery information they need to implement a predictive maintenance program. The answers also assist in selecting the Rotating Machinery Information Systems (ROMIS®) best suited for your program. ►



"Depending on the responsibilities of each department, overall values, trends, process variable information, steady-state dynamic vibration and transient dynamic vibration data may be needed for your predictive maintenance program on rotating machinery."

Who needs machinery information?

To answer this question, you must identify:

- ☐ The departments or groups within your organization who use rotating machinery information.
- ☐ The departmental objectives and responsibilities of each group.
- ☐ The type of machinery information they need to carry out their responsibilities.

Table 1, "Identifying Who Needs Machine Information," gives you a guideline for the types of questions to ask to determine who needs machinery information in your facility and the type of information that is required.

What type of information is needed?

Three departments generally use rotating machinery information: Production, Maintenance, and Rotating Machinery Specialists. Each department's objectives and responsibilities determine the type of machinery information needed.

Depending on the responsibilities of each department, the following types of information may be needed:

- ☐ Overall values
- ☐ Trends
- ☐ Correlative process variable information
- ☐ Steady-state dynamic vibration data
- ☐ Transient dynamic vibration data

Definitions of each type of information are also listed in Table 1.

On what types of machines is information needed?

Next, rotating machinery is classified by criticality to your operation. The designations for classification vary from plant to plant. For our purposes, we classify machinery as:

Critical: Absolutely necessary for continued plant operation and generally not spared.

Essential: Necessary for at least partial plant operation, but may be spared or partially spared.

General Purpose: Nonessential to the major plant process. Or, if essential, is multi-spared.

In what machine operating modes?

The criticality of the machinery determines the operating modes for monitoring and acquiring information from each machine.

The operating modes are generally divided into three categories: On-line monitored (OM), periodically monitored (PM), and startup/shutdown mode (SS).

Critical, and some essential, machines are usually monitored continuously. On-line monitoring provides information on overall values, trends, and alarm status. It also can provide information on steady-state dynamic vibration.

Some essential and general purpose machinery are periodically monitored to acquire overall values for trending and steady-state dynamic vibration data for analysis.

Startup and shutdown information is acquired before and after overhauls or turnarounds on critical and problem machinery. It also is acquired during testing and commissioning of new machinery.

How these answers assist in designing a predictive maintenance program

The answers to the four basic questions serve as a guide for identifying the type of machinery information and ROMIS systems your personnel require to implement a predictive maintenance program.

Depending on your machinery information needs, different types of ROMIS systems are available. A company can utilize on-line ROMIS systems, for example, on its critical machinery, and simpler, less expensive on-line or periodic ROMIS systems on its essential and general purpose machinery.

Proper selection and use of ROMIS systems are the cornerstones to achieving the universal maintenance goal: Getting the maximum use from your rotating machinery with the minimum maintenance expense—without sacrificing rotating machine reliability. ■

Table 1
Identifying Who Needs Machine Information

Complete this form for every department that requires machine information.

Department:
☐ Production ☐ Maintenance ☐ Rotating Machinery Specialist ☐ Management ☐ Other _____

Department Objectives and Responsibilities:

1. _____

2. _____

3. _____

4. _____

People in the department, by job function, who require machinery information:

1. _____ 4. _____

2. _____ 5. _____

3. _____ 6. _____

When does each person listed above feel it is important to obtain information on his machinery?:
On critical machinery: ☐ Continuously ☐ Periodically ☐ At alert level only ☐ At danger level only ☐ After failure ☐ Startup/Shutdown

On essential machinery: ☐ Continuously ☐ Periodically ☐ At alert level only ☐ At danger level only ☐ After failure ☐ Startup/Shutdown

On general purpose machinery: ☐ Continuously ☐ Periodically ☐ At alert level only ☐ At danger level only ☐ After failure

Where is the machine information needed?:
☐ At the machine ☐ In the control room ☐ Remotely ☐ In process computer ☐ In the laboratory ☐ Other _____

What type of information is needed to perform the responsibilities of each job?:
☐ Overall levels ☐ Trends of vibration ☐ Trends of process variable ☐ Correlative process variable information
☐ Steady-state dynamic vibration data ☐ Transient dynamic vibration data

Definition of machine information terms:
Overall Values: Instantaneous values of supervisory parameters, including overall vibration levels, alarm status, axial position indication, and bearing temperature.

Trends: A record of parameter changes over a period of time, such as maximum and minimum values over time, sequence of events, and end-of-shift reports.

Correlative Process Variable Information: Correlation of flows, speeds, loads, temperatures, vibration amplitudes, and other variables to determine how changes in one variable affect the other variables.

Steady-State Dynamic Vibration Data: Vibration signals obtained from machinery transducers while the machine is on-line that are presented in the form of vibration waveform, shaft orbit, spectrum, impedance, and rotative speed amplitude and phase plots.

Transient Dynamic Vibration Data: Vibration signals obtained from machinery transducers while the machine is changing condition—such as speed, load, startup, and shutdown—and presented in the form of Bodé, polar, spectrum cascade, and time base plots.